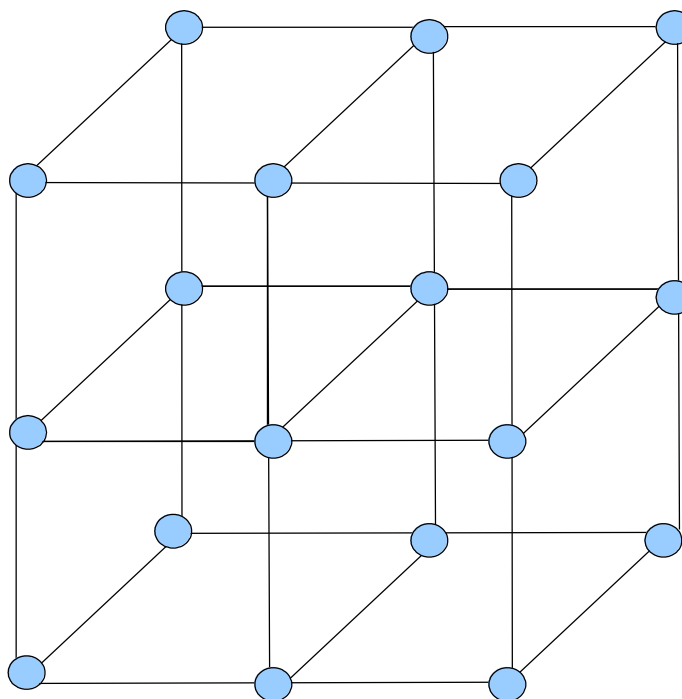
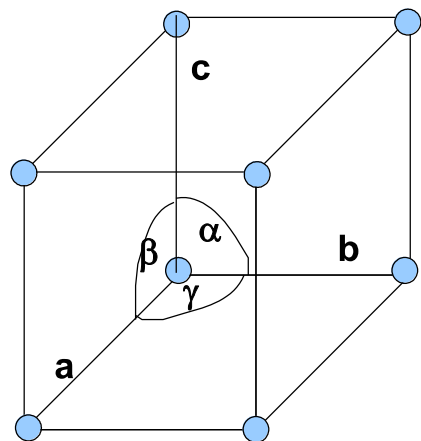
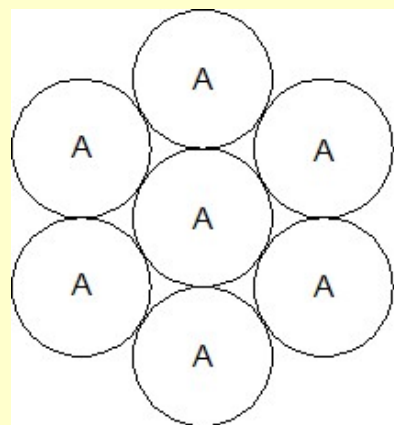


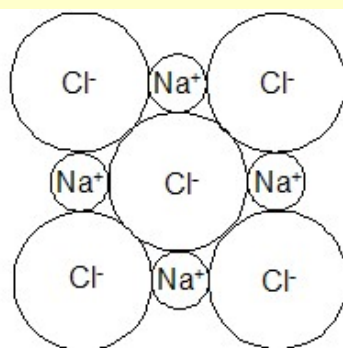
Fizyka Ciała Stałego



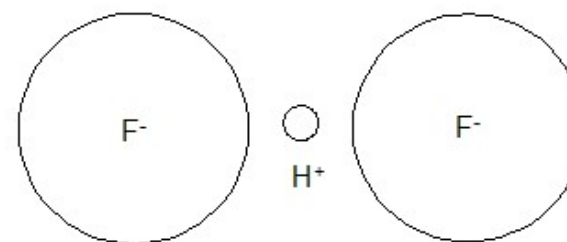
Kryształy



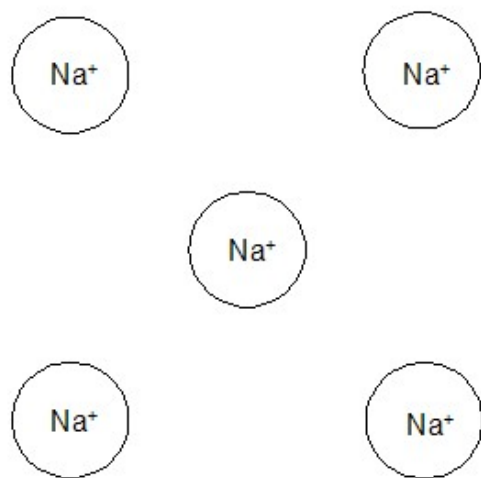
argon krystaliczny
(siły Van der Waalsa)



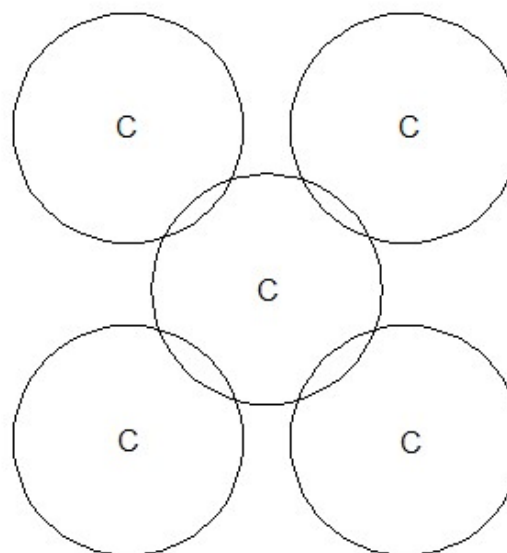
chlorek sodu
(wiązanie jonowe)



Wiązanie wodorowe



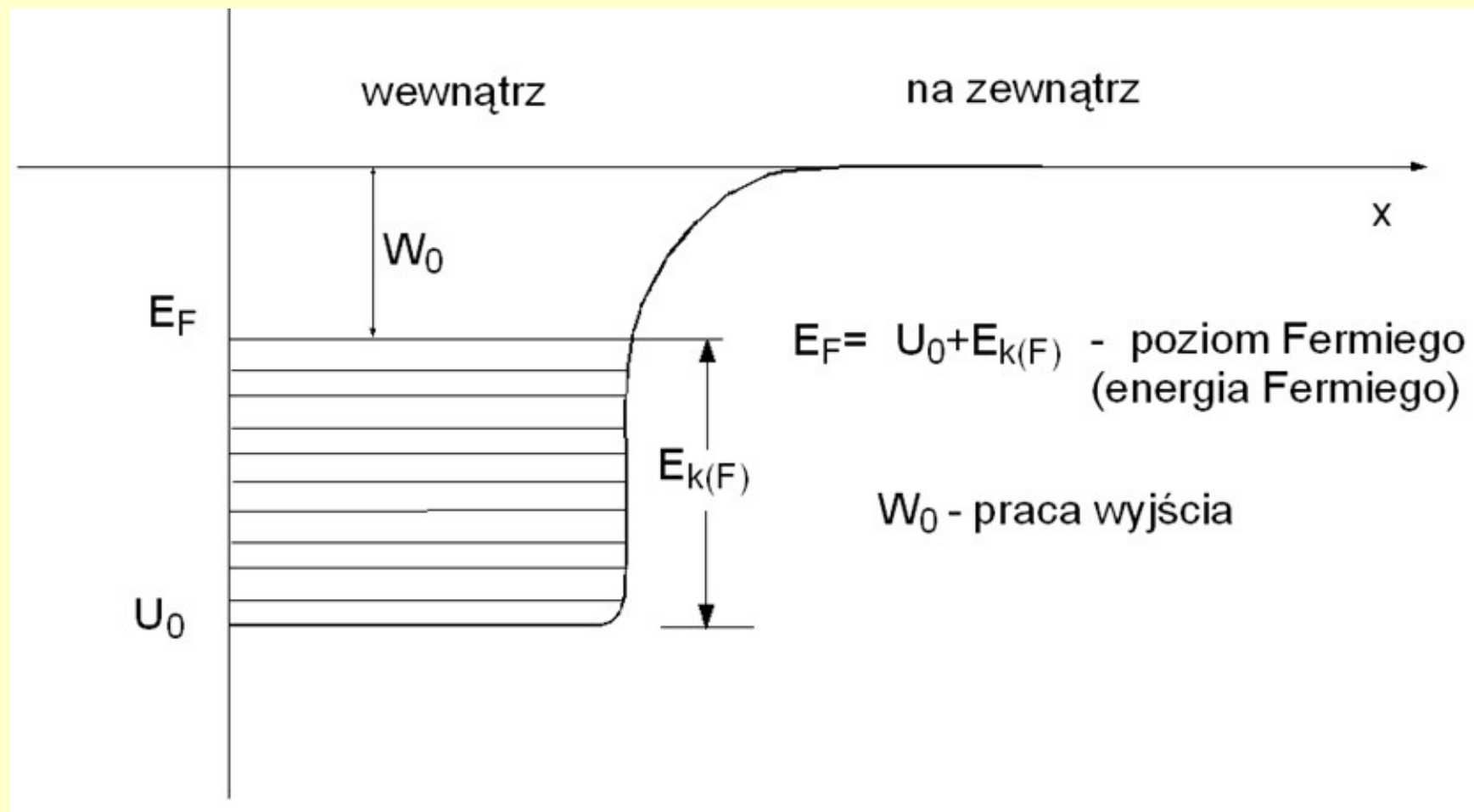
sód
(wiązanie metaliczne)

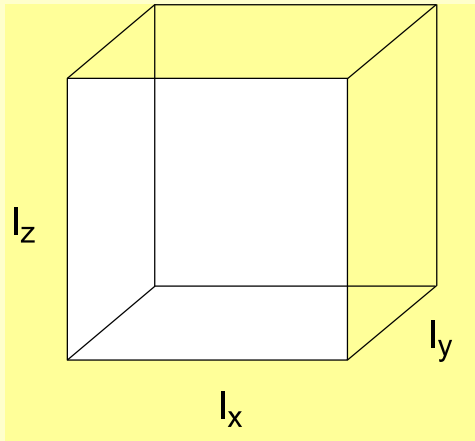


diament
(wiązanie kowalencyjne)

Wiązania kryształów

Teoria swobodnych elektronów w metalach





Elektrony zamknięte w
sześciennym pudle

w jednowymiarowej studni
potencjału było:

$$p = n \frac{h}{2l}$$

$$p_x = n_x \frac{h}{2l_x}$$

$$p_y = n_y \frac{h}{2l_y}$$

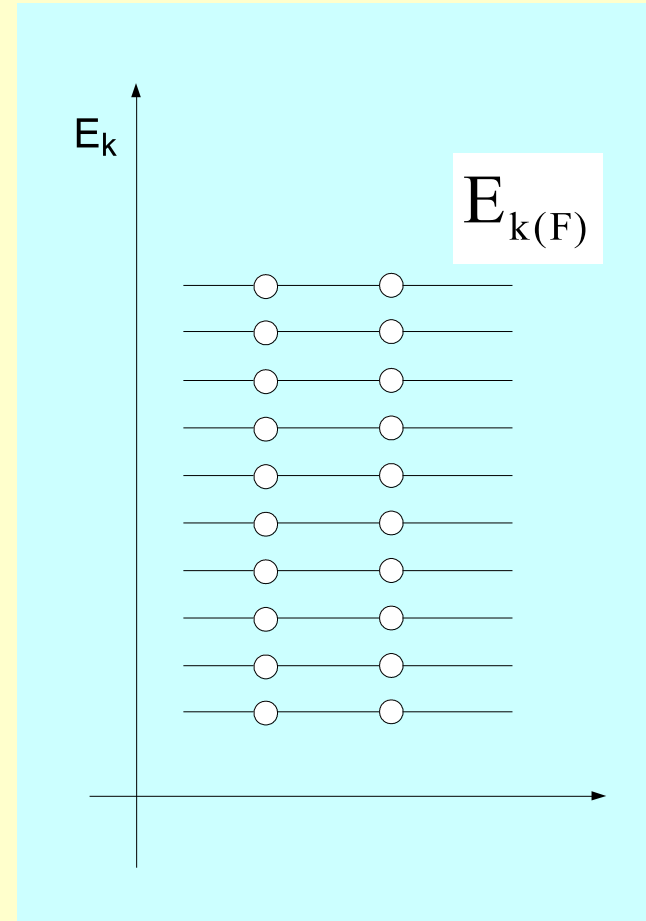
$$p_z = n_z \frac{h}{2l_z}$$

Przyjmijmy dla uproszczenia:

$$l_x = l_y = l_z = 1$$

$$p^2 = p_x^2 + p_y^2 + p_z^2 = \frac{h^2}{4l^2} (n_x^2 + n_y^2 + n_z^2)$$

$$E_k = \frac{p^2}{2m} = \frac{h^2}{8ml^2} (n_x^2 + n_y^2 + n_z^2)$$



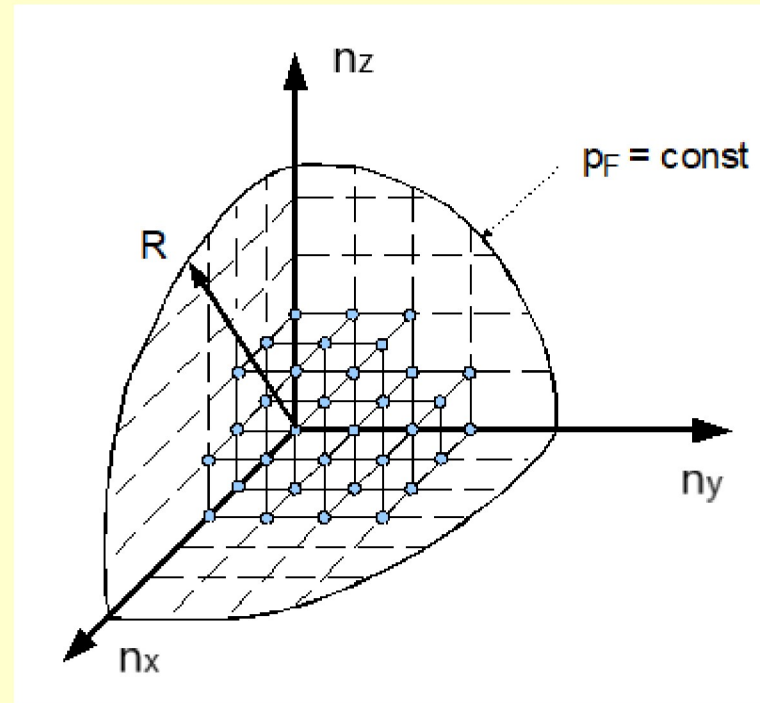
Obliczmy energię
Fermiego

$$p_F = p_{x_F} = n_{x(F)} \frac{h}{2l}$$

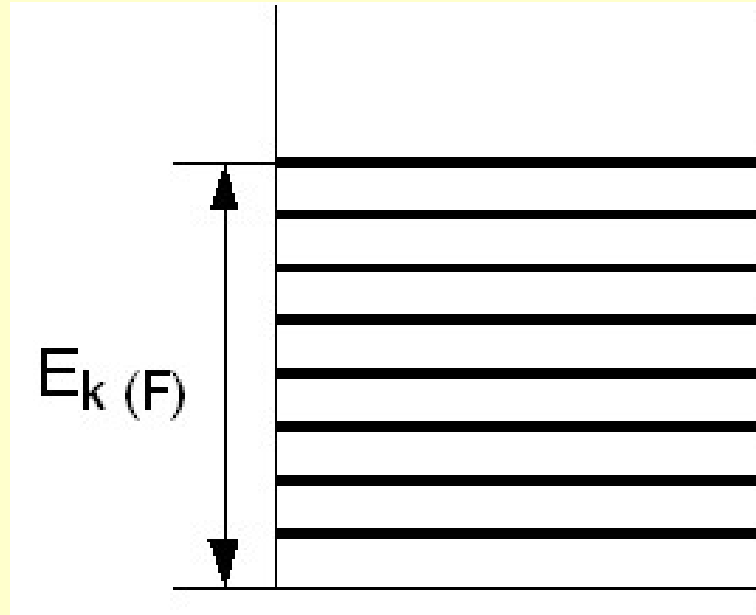
$$R = n_{x(F)}$$

$$E_{k(F)} = \frac{p_F^2}{2m}$$

$$E_{k(F)} = \frac{h^2}{8m} \left(\frac{3}{\pi} n \right)^{\frac{2}{3}}$$



$$E_{k(F)} = \frac{h^2}{8m} \left(\frac{3}{\pi} n \right)^{\frac{2}{3}}$$



Przykład: $E_{k(F)}$ dla litu

$$\rho = 0,534 \text{ g/cm}^3$$

$$A = 6,94$$

$$n = \frac{N_A}{V_{mol}} = \frac{N_A \rho}{A}$$

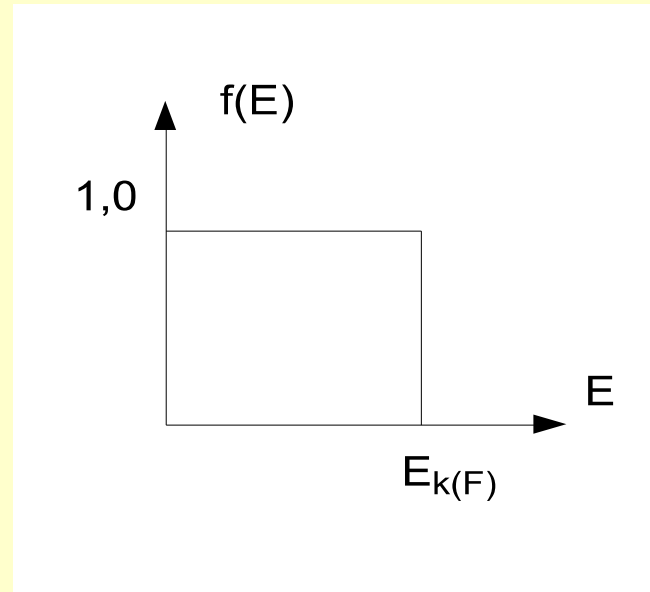
$$E_{k(F)} = 4,7 \text{ eV}$$

Rozkład Fermiego-Diraca

W temperaturze $T=0$

$$f(E) = 1 \quad \text{gdy} \quad E \leq E_{k(F)}$$

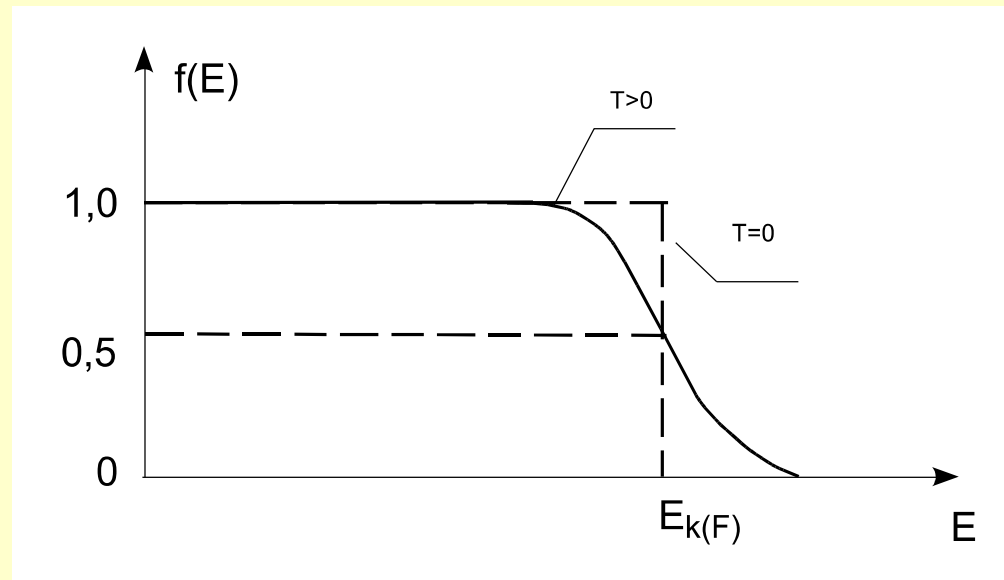
$$f(E) = 0 \quad \text{gdy} \quad E > E_{k(F)}$$

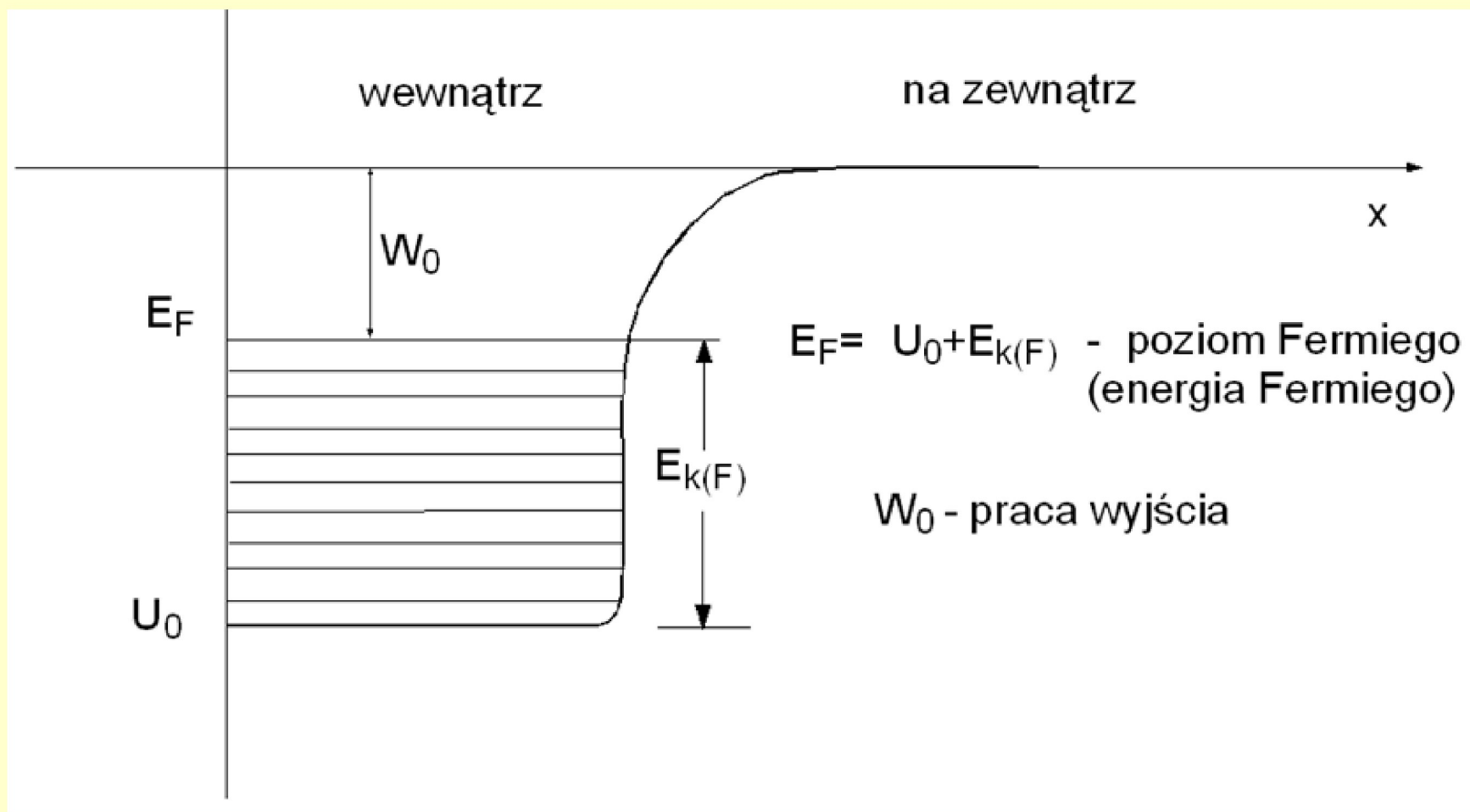


W temperaturach $T>0$

$$f(E) = \frac{1}{e^{(E-E_{k(F)})/kT} + 1}$$

$$\bar{E} = \frac{3}{5} E_{k(F)}$$

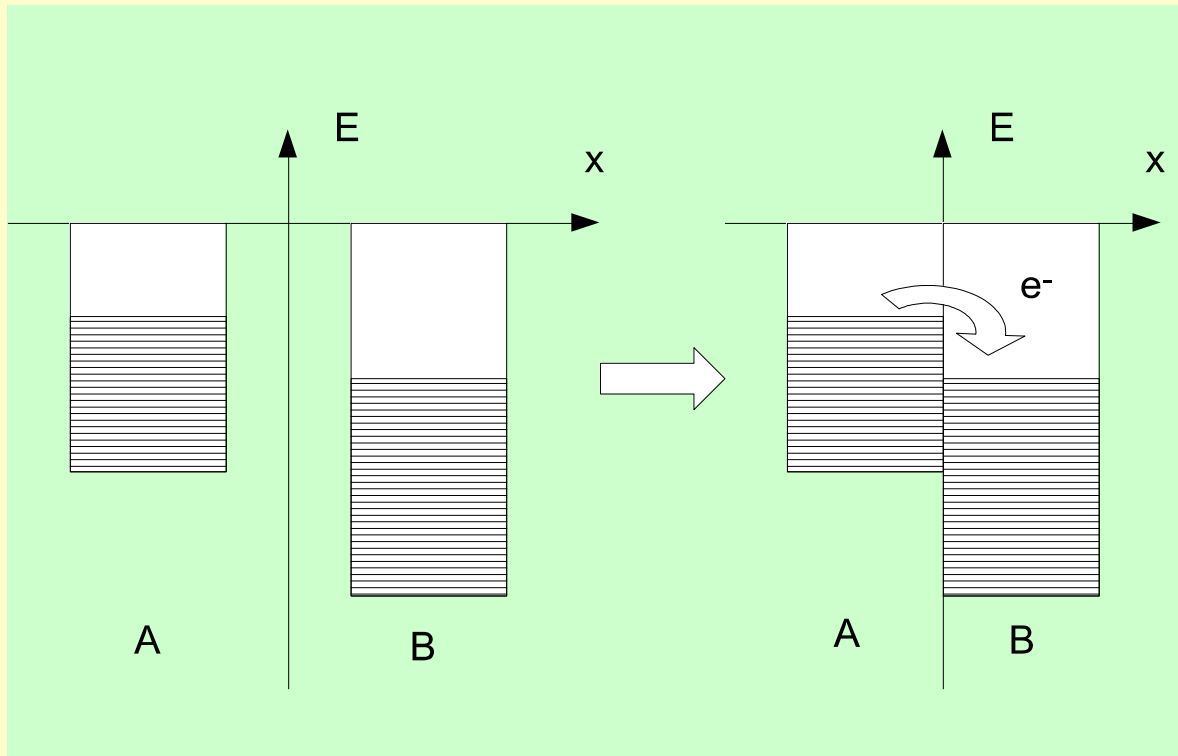




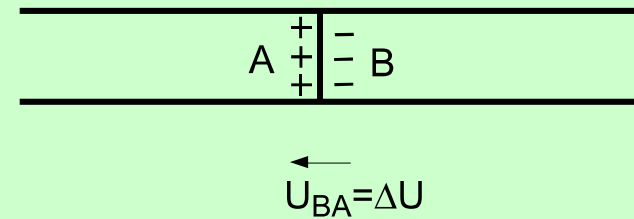
$$E_F = U_0 + E_{k(F)} = -W_0$$

$$E_F = -W_0$$

Potencjał kontaktowy

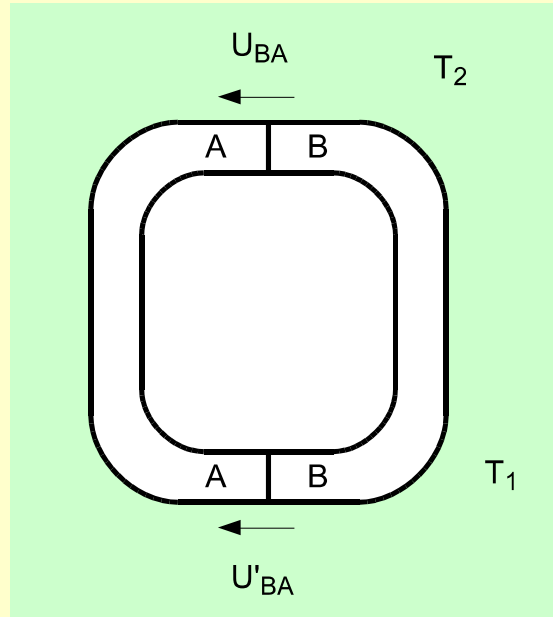


$$\Delta U = E_{F(A)} - E_{F(B)}$$



Działanie termopary:

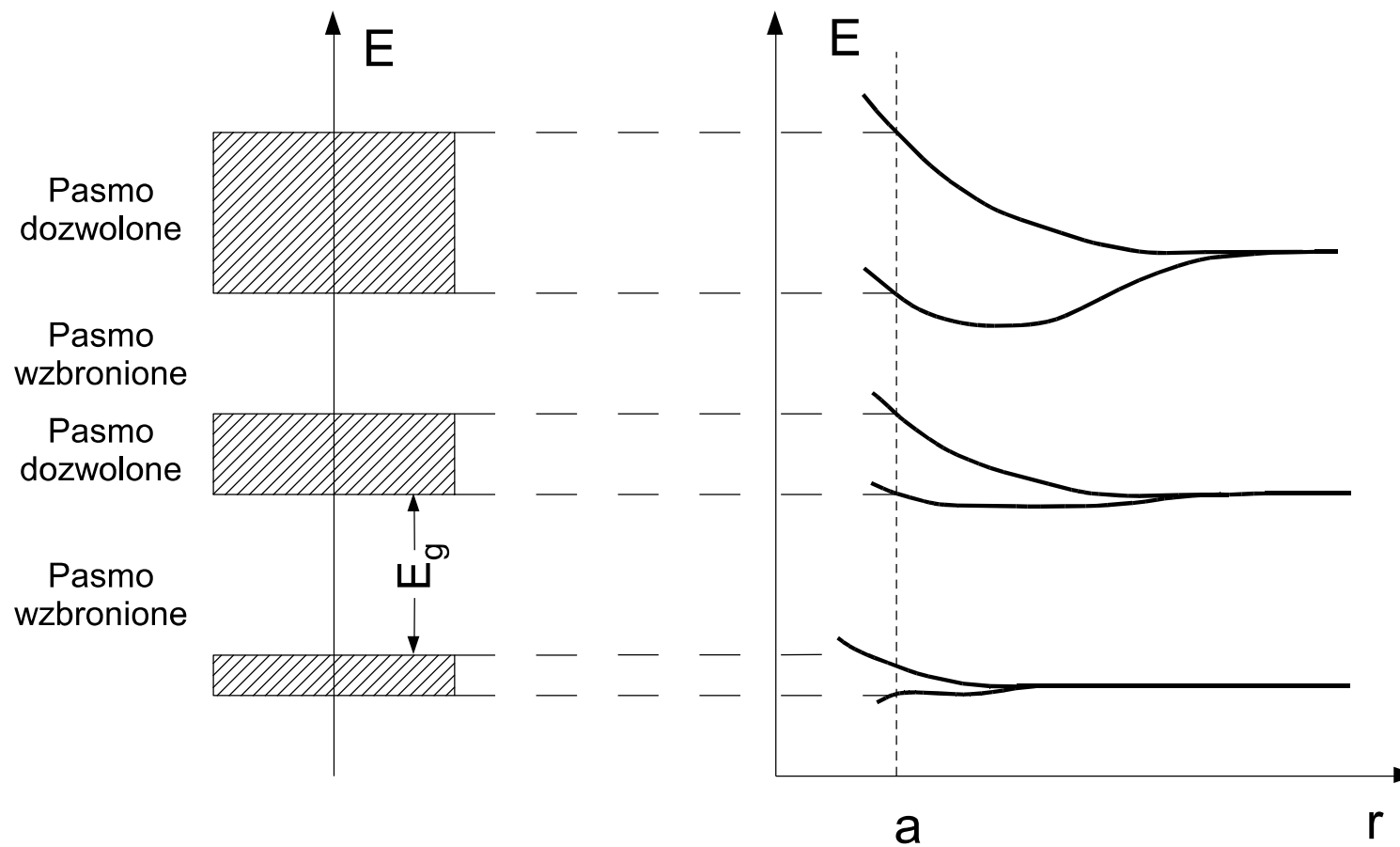
$$U = a + bT$$

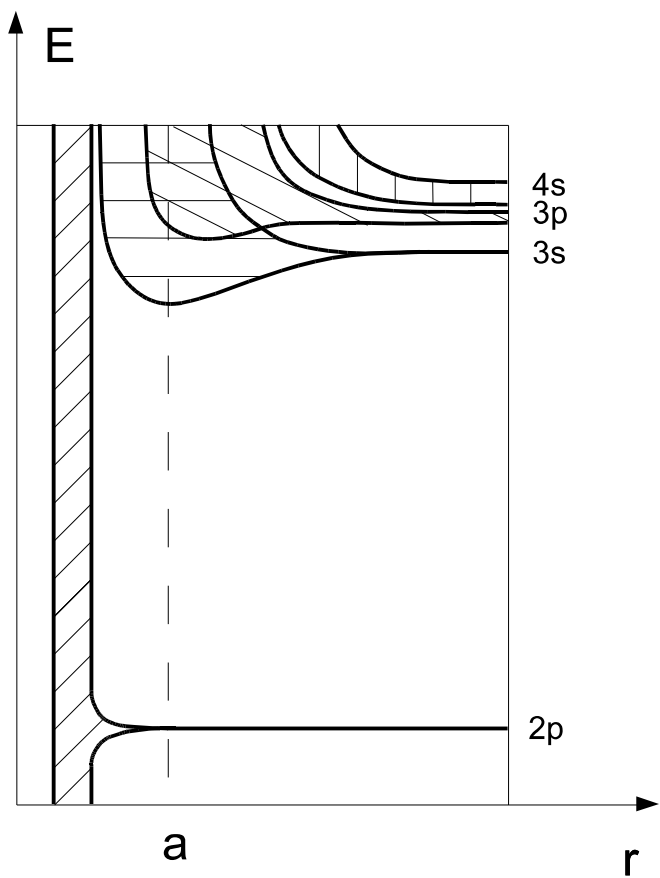


Fe/konstantan	→	do temperatury $t = 760^{\circ}\text{C}$
Cu/konstantan	→	do temperatury $t = 400^{\circ}\text{C}$
chromel/alumel	→	do temperatury $t = 1370^{\circ}\text{C}$
Pt/Pt+10%Ra	→	do temperatury $t = 1700^{\circ}\text{C}$

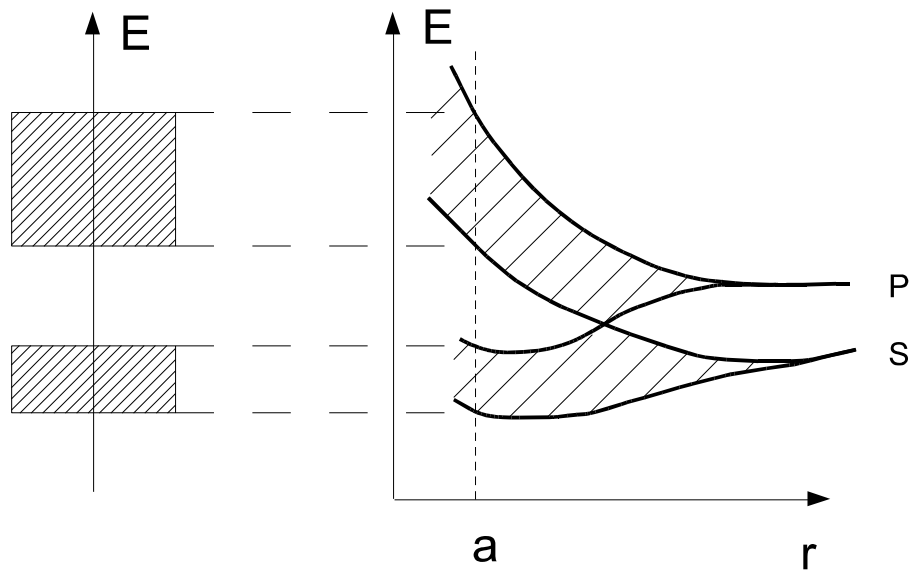
konstantan to stop: Cu(60%) i Ni(40%)
alumel to stop: Ni(94,5%); Mn(2,5%); Al(2%); Si(1%)
chromel to stop: Ni(90%); Cr(10%)

Model silnego wiązania elektronów



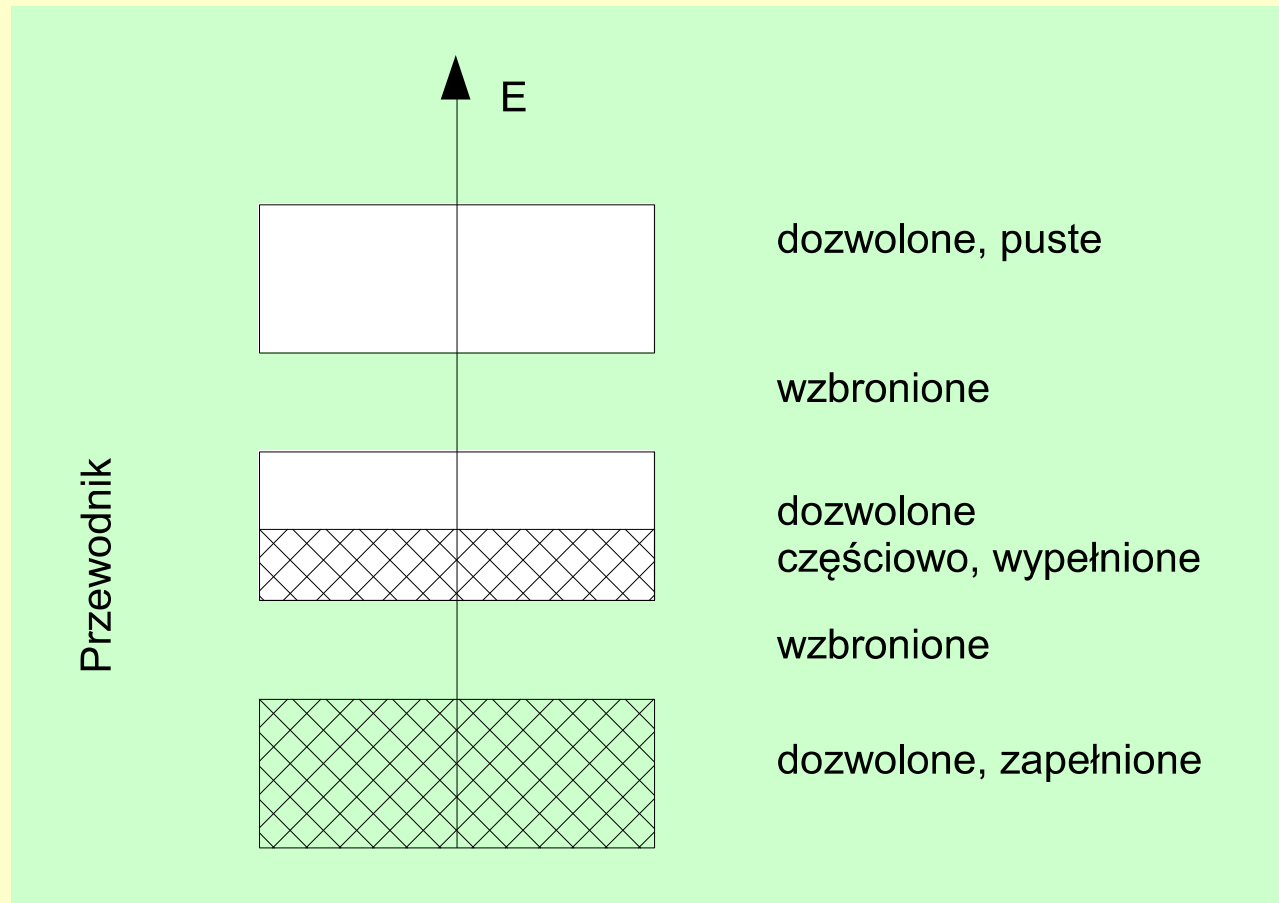


sód



diament

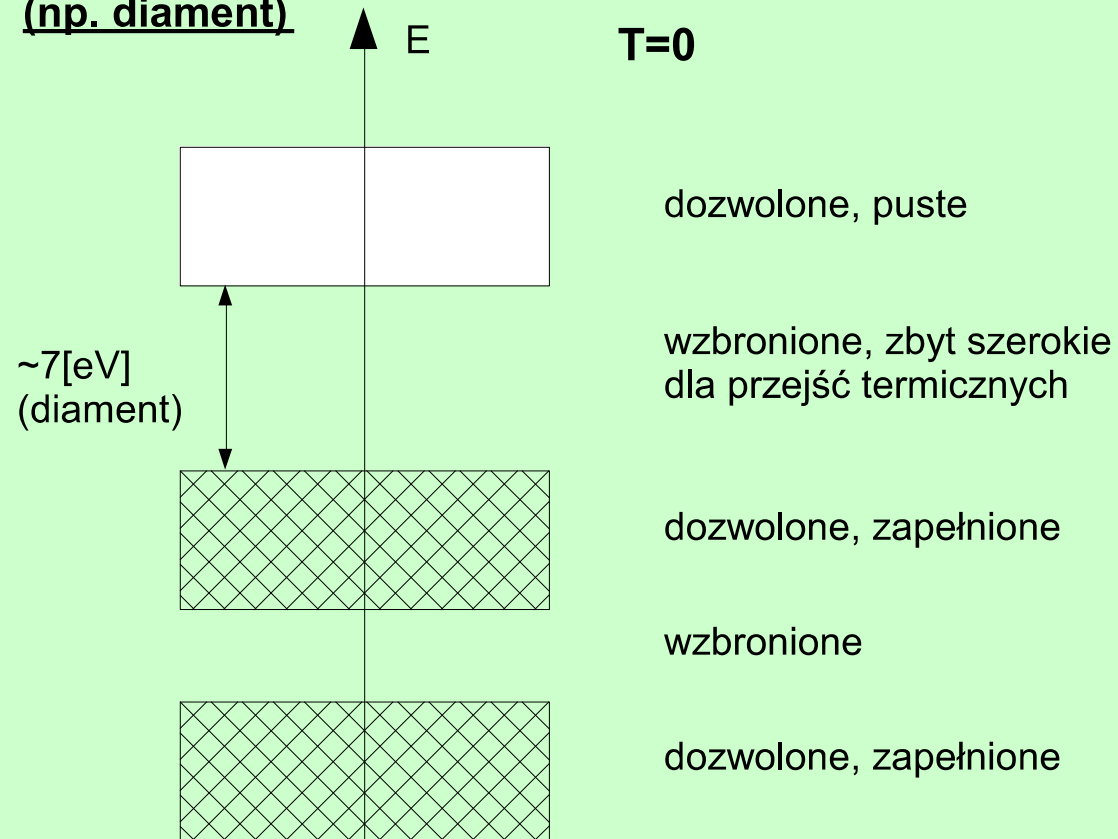
Przewodniki, półprzewodniki i izolatory



Przewodnik

IZOLATORY

(np. diament)



PÓŁPRZEWODNIKI
(IV grupa ukł. Okresowego
np. Ge, Si)

